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Elk Ecology Studies

MONTANA ROOM

ELK POPULATION DYNAMICS

AND

BREEDING BIOLOGY

NON-CIRCULATING

Annual Progress Report - 1986

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JOB PROGRESS REPORT
RESEARCH PROJECT

State: Montana

Project No.: W-120-R-17 Project Title: Statewide Wildlife Research

Program No.: I Program Title: Big Game Research

Study No.: BG-3.1 Study Title: Elk Ecology Studies

Job No.: 2 Job Title: Elk Population Dynamics and Breeding Biology

Period Covered: July 1, 1985 - June 30, 1986

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Date: Sept. 24, 1986

Cover Photo by Perry Backus

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INTRODUCTION

Elk management in Montana has been primarily directed toward increasing elk numbers and maintaining a diversity of choice in elk hunting opportunity. However, either-sex elk hunting has decreased substantially from the early 1960s. In 1963, 67% of Montana's hunted elk habitat was open to season-long either-sex hunting; by 1985 this had dropped to 1% (Wildl. Div., MDFWP 1985). Although hunting for antlered bull elk has remained quite liberal, branch-antlered bull only areas have been increasing. In the early 1960s no Montana elk hunting areas were restricted to branch-antlered bulls only for hunters wanting or restricted to the taking of an antlered bull. By 1985, 3% of Montana's elk habitat was restricted to branch-antlered bull hunting. Depending on the area, this restriction resulted from either some hunters wanting a better opportunity to harvest a large or "trophy" bull or the concern over the long term biological affects of yearling bulls siring most of the calves.

Available evidence suggests that low proportions of mature bulls in elk populations might negatively affect calf production and/or survival and population size (Hines and Lemos 1979, Prothero et al. 1979, and Smith 1980). Low observed calf:cow ratios in the Gravelly Mountains during the winters of 1979-80 and 1980-81 (18-35 calves/100 cows versus 55-68/100 during 1970-75, Chrest and Herbert 1980, 1981) coincided with low antlered bull/cow ratios. Concern over these ratios resulted in changes in hunting regulations in hunting district 324 during 1981. The early archery season was eliminated, and the kill during the general elk season was limited to branch-antlered bulls. The branch-antlered bull regulation was implemented in several adjacent hunting districts in subsequent years.

This study was initiated in January, 1984, to assess the role and importance of various hunting strategies and differing kinds and levels of hunting pressure on elk population characteristics and dynamics. Emphasis has been and will continue to be directed toward breeding biology, reproductive success and calf recruitment, and seasonal distribution, movements, and habitat use of adult males and females.

OBJECTIVES

1. Determine the effects of alternate hunting strategies and various harvest rates on elk population dynamics and habitat use due to the steady increase of hunting pressure and loss of habitat security.

2. Test the hypothesis that when mature bulls (2-1/2+ years) make up less than 5% of an elk population during the breeding season, the net reproductive success will be less compared to when the population has greater than 5% mature bulls.

3. Assist biologists with evaluation of existing elk population data and utilize the results from this study as they become available to better manage and understand the effects of various harvest rates and hunting season types on elk population dynamics.

STUDY AREA

Because of low observed calf/cow and mature bull/cow ratios, the popularity of the area for hunting, and the changes in hunting regulations already in place, the Gravelly - Snowcrest Mountains in southwestern Montana were selected as the primary study area. In 1984 and 1985 work was concentrated on the elk which winter on the Madison-Wall Creek Game Range south of Ennis. The physiography and vegetation of this area have been described by Eustace (1967). In 1986, work was expanded to include the elk that winter on the Blacktail Game Range southeast of Dillon. The study area primarily involves

MDFWP hunting districts 322, 323, 324, 325, 326, 327 and 330 (Fig. 1).

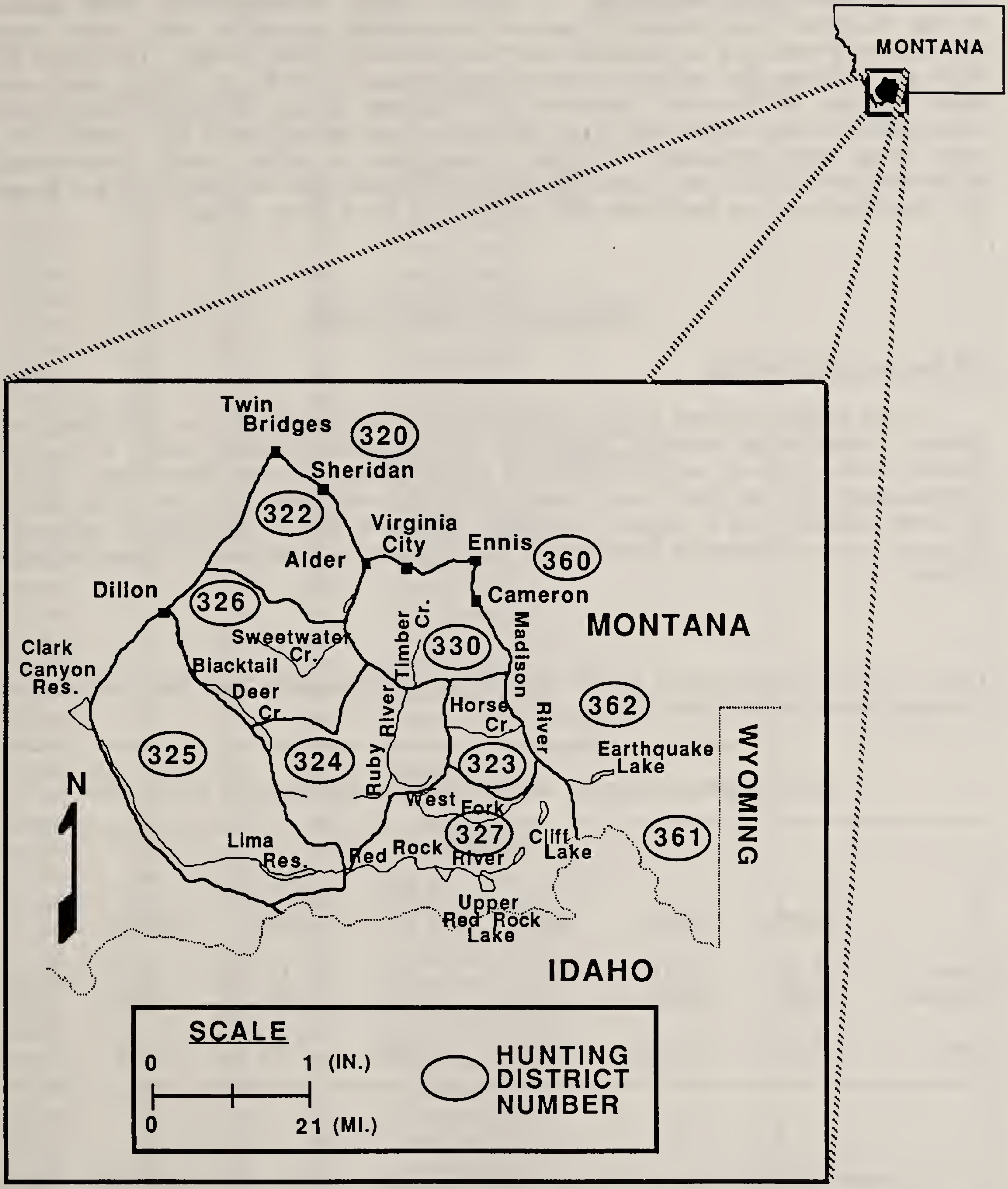

Figure 1. General location and relative position of hunting districts within the Gravelly-Snowcrest Study Area.

METHODS

Methods employed were the same as previously reported (Lonner and Schladweiler 1985) with the following exceptions: 1) winter capture and handling of all elk was done on the Blacktail Game Range; 2) neonatal calves were captured by hand while searching for them from horseback or helicopter near the Blacktail Game Range; 3) elk pellet groups were not collected for analysis of diaminopimelic acid (DAPA); 4) hunter check stations were operated at 3 primary locations on weekends during the general rifle season; 5) letters with jaw tags were sent to 1,950 hunters who had antlerless elk permits for the area. These letters requested the hunter, if successful in killing an elk, to save the head or jaw and leave it in a "jaw barrel" at specified locations near the study area; and 6) summer elk classifications were made from the ground and a fixed wing aircraft.

RESULTS AND DISCUSSION

Elk Capture and Handling

Drive netting resulted in the capture and handling of 49 elk on 4-6 March on the Blacktail Game Range, including 1 recapture. The recaptured animal was a 9-10 year old female, radio-collared on the Blacktail Game Range during the winter of 1978. Unfortunately, by the time it was driven into the net we didn't have any radio collars left so it was collared with a regular neckband. Sex and age of all animals captured and released during drive netting are shown in Table 1 along with the number of each group radio collared.

Table 1. Sex and age class of all elk captured and released, and those radio-collared, on the Blacktail Game Range, March 1986.

Total caught and number radio-collared (in parentheses) by age class.

	Age Class					
	calves	1 1/2	2 1/2	3 1/2-5 1/2	6 1/2-8 1/2	9 1/2+
Males	4 (3)	5 (5)	0	0	0	0
Females	5 (2)	8 (5)	2 (2)	17 (9)	7 (4)	1 (0)
Total	9 (5)	13 (10)	2 (2)	17 (9)	7 (4)	1 (0)

To help determine early neonatal calf mortality, twenty-one additional newborn calves were captured and fitted with collars and/or ear tags between 3-10 June 1986. Eighteen of these were instrumented with radio collars equipped with mortality sensors, two were instrumented with radio collars without mortality sensors and one with ear tags only. General information from all elk marked and released in 1986 is presented in Table 2.

Table 2. General information from 70 elk handled on or near the Blacktail Game Range during March and June 1986.

Id No.	Month	Day	Year	Location	Sex[a]	Age
00186	06	06	86	Lower Coal Creek	1	0.1
00286	06	04	86	N.Fk. Crow Creek	1	0.1
00386	06	04	86	Crow Creek	1	0.1
00486	06	05	86	Long Creek	1	0.1
00586	06	05	86	Long Creek	1	0.1
00686	06	09	86	Poison Creek	1	0.1
00786	06	09	86	Lower Long Creek	1	0.1
00886	06	09	86	Fish Creek	1	0.1
00986	06	09	86	Fish Creek	1	0.1
01086	06	10	86	Landon Ridge	1	0.1
01186	06	10	86	Upper W.Fk. Madison R.	1	0.1
01286	06	10	86	Upper W.Fk. Madison R.	1	0.1
10186	03	06	86	Blacktail G.R.	1	0.5
10286	03	04	86	Blacktail G.R.	1	0.5
10386	03	04	86	Blacktail G.R.	1	0.5
10486	03	05	86	Blacktail G.R.	1	0.5
20186	03	05	86	Blacktail G.R.	1	1.5
20286	03	05	86	Blacktail G.R.	1	1.5
20386	03	05	86	Blacktail G.R.	1	1.5
20486	03	05	86	Blacktail G.R.	1	1.5
20586	03	06	86	Blacktail G.R.	1	1.5
50186	06	03	86	Lower Coal Creek	2	0.1
50286	06	04	86	N.Fk. Crow Creek	2	0.1
50386	06	04	86	Crow Creek	2	0.1
50486	06	04	86	Crow Creek	2	0.1
50586	06	05	86	Long Creek	2	0.1
50686	06	05	86	Long Creek	2	0.1
50786	06	09	86	Lower Long Creek	2	0.1
50886	06	10	86	Murphy Creek	2	0.1
50986	06	10	86	Anderson Creek	2	0.1
60186	03	06	86	Blacktail G.R.	2	0.5
60286	03	06	86	Blacktail G.R.	2	0.5
60386	03	06	86	Blacktail G.R.	2	0.5
60486	03	05	86	Blacktail G.R.	2	0.5
60586	03	04	86	Blacktail G.R.	2	0.5
70186	03	04	86	Blacktail G.R.	2	1.5
70286	03	04	86	Blacktail G.R.	2	1.5
70386	03	05	86	Blacktail G.R.	2	1.5
70486	03	04	86	Blacktail G.R.	2	1.5
70586	03	05	86	Blacktail G.R.	2	1.5
70686	03	06	86	Blacktail G.R.	2	1.5
70786	03	06	86	Blacktail G.R.	2	1.5
70886	03	06	86	Blacktail G.R.	2	1.5
80186	03	06	86	Blacktail G.R.	2	2.5
80286	03	05	86	Blacktail G.R.	2	2.5

Table 2. Continued.

Id No.	Month	Day	Year	Location	Sex[a]	Age
90186	03	04	86	Blacktail G.R.	2	3.5
90286	03	04	86	Blacktail G.R.	2	3.5
90386	03	05	86	Blacktail G.R.	2	3.5
90486	03	05	86	Blacktail G.R.	2	3.5
90586	03	06	86	Blacktail G.R.	2	3.5
90686	03	06	86	Blacktail G.R.	2	3.5
90786	03	06	86	Blacktail G.R.	2	3.5
90886	03	06	86	Blacktail G.R.	2	3.5
90986	03	06	86	Blacktail G.R.	2	3.5
91086	03	06	86	Blacktail G.R.	2	3.5
91186	03	05	86	Blacktail G.R.	2	4.5
91286	03	06	86	Blacktail G.R.	2	4.5
91386	03	06	86	Blacktail G.R.	2	4.5
91486	03	05	86	Blacktail G.R.	2	4.5
91586	03	04	86	Blacktail G.R.	2	4.5
91686	03	04	86	Blacktail G.R.	2	5.5
91786	03	04	86	Blacktail G.R.	2	5.5
91886	03	04	86	Blacktail G.R.	2	6.5
91986	03	04	86	Blacktail G.R.	2	6.5
92086	03	05	86	Blacktail G.R.	2	6.5
92186	03	06	86	Blacktail G.R.	2	6.5
92286	03	06	86	Blacktail G.R.	2	7.5
92386	03	06	86	Blacktail G.R.	2	7.5
92486	03	04	86	Blacktail G.R.	2	8.5
92586	03	06	86	Blacktail G.R.	2	9.5

[a] 1=Male, 2=Female

Fate of radio collared neonatal calves

A total of 20 newborn calves were captured and radio- collared in 1984, 8 in 1985 and 20 in 1986. Five of the 48 radio-collared calves thus far marked in the study died within about 10 days of their capture. Necropsies indicated that these elk died of starvation and apparent abandonment by their mothers. Three of these deaths occurred from newborns captured near the Madison-Wall Creek Game Range in 1984-85 and the other two were from newborns captured during the spring in 1986 near the Blacktail Game Range. One newborn marked in 1985 appeared to have died from predation, since when the collar was recovered (13 days after the calf was marked) it had tooth marks and blood on it, but no calf remains were present. Overall, 88 percent of radio-collared newborns have survived their first month of life.

At the end of this reporting period 19 calves (1 marked in 1985 and 18 marked in 1986) had radios that were still functioning and indicating they were alive. The remaining animals were tracked until their radios quit (12 animals) or were shed (11 animals) while still transmitting. The latter were all recovered. One of the calves marked in 1984 and whose radio had quit was recaptured in the February,1985, drive netting operation, but its radio was missing, apparently having been shed after it ceased functioning. This animal was observed on the Madison-Wall Creek Game Range as late as 29 April, 1986. Two of the 1984 calves with radios that quit were shot during the 1985 general rifle season. Three of the radios that were put on calves in 1985 quit transmitting during winter-spring, 1986, and only one was functioning through June, 1986. Therefore, by the end of the report period the status of 28 of the 48 calves thus far radio-collared was known, with 20 of these known to be alive. The status of the remaining 20 animals is unknown, but they were alive at the time their radios quit functioning or were shed.

Blood Tests and Pregnancy Determinations

Results of blood tests from all animals thus far handled are being analyzed by Mark R. Johnson, a veterinary student at Colorado State University, Fort Collins. He is investigating the possibility of establishing normal ranges of blood parameters. Establishing normal values for hematology and blood chemistry of elk will be a starting point in interpreting blood parameters. If these normals can be established, this may help wildlife managers identify causes of high mortality or low productivity when they occur.

Among the 3 methods used for detecting pregnancy, the pregnancy tester was used primarily on yearling and older cows trapped in winter. Blood samples were obtained from all animals caught throughout the year. Except for neonates, these samples were checked for serum progesterone and protein B levels (Sasser et al. 1986) as indicators of pregnancy. In a few instances insufficient blood was available to test for both blood parameters or a sample was lost due to spillage or breakage of a sample tube. Results of serum progesterone analysis were not available prior to the end of the report period.

Among the 2 blood parameters used for detecting pregnancy, protein B levels appear most accurate. Blood from a control group of 35 elk shot by hunters during the 1984-85 late season near Gardiner, Mont. was tested for protein B. These elk were all examined for pregnancy with the results compared to the results from the protein B tests. All comparisons were 100% accurate (Palmisciano 1986). Thus far in this study, only 1 apparent error (of 177 samples tested) was found using this method on all sex and age classes handled. This was a yearling female captured in 1984 which both the pregnancy tester and serum progesterone level indicated pregnant, but in which protein B was not detected. By contrast, several female calves and yearlings would have been called pregnant using the threshold value of serum progesterone indicated by our pregnant adult females. This level (3.8 ng/ml) is almost identical with that (3.7 ng/ml) suggested by data from both yearling and adult cows reported by Weber et al. (1982).

If blood is to be used for determining pregnancy, the protein B level appears to be the most useful blood parameter currently available. Further evaluation of this technique is required to determine how early in pregnancy it can be reliably used on elk and if the amount of this substance in the blood can be used to back date to conception.

Pregnancy determinations made using the pregnancy tester in 1986 resulted in 3 errors out of 35 trials. All errors resulted from pregnant cows (1 yearling and 2 adults) being called open. This technique should be tested further to determine both accuracy and how early in pregnancy it will detect a fetus.

Pregnancy determinations for 118 females (24 yearlings, 6 2-1/2 year olds, 56 3-1/2 to 5-1/2 years old, 23 6-1/2 to 8-1/2 years old, 7 9-1/2 years and older, and 2 unknown age adults) have thus far been made using up to all 3 methods. The age group with the highest overall pregnancy rate was the 2 1/2 year old group with 100% pregnant. Pregnancy rates for other age groups were: yearlings 42%, 3-1/2 to 5-1/2 - 93%, 6-1/2 to 8-1/2 - 96%, and 9 -1/2 and older - 86%. The pregnancy rate of all adult (2-1/2 years old or older) females thus far tested was 94% (Fig. 2).

Blood samples from 226 of the animals handled to date were tested for antibodies against brucellosis, blue tongue, anaplasmosis, and leptospirosis. All tests for brucellosis

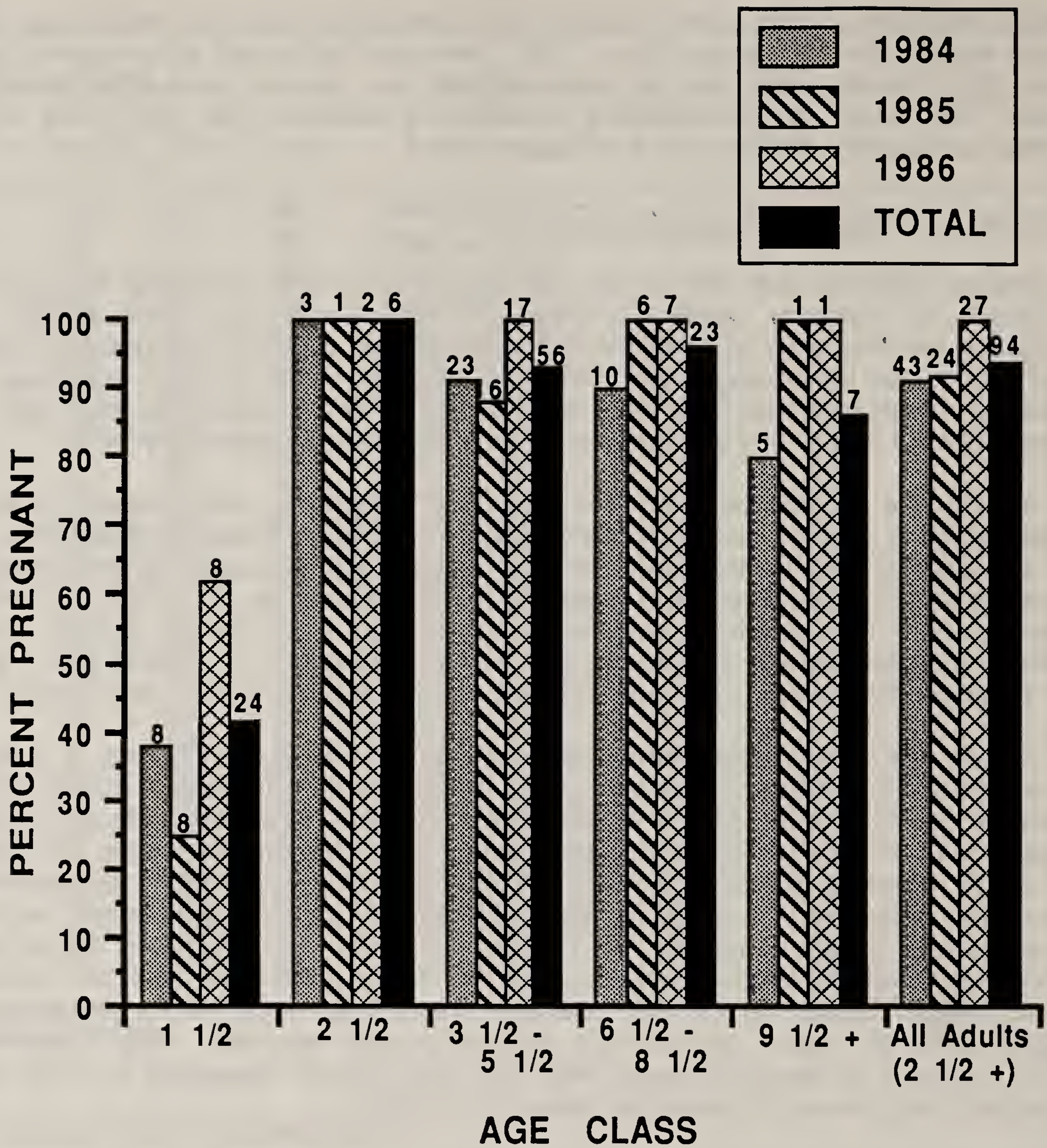

Figure 2. Pregnancy rate of yearling and older cow elk captured on or near the Madison-Wall Creek (1984-1985) and Blacktail (1986) Game Ranges. Numbers above bars indicate sample size.

and blue tongue were negative. All tests for leptospirosis were negative for elk from the Madison-Wall Creek area. Five blood samples from elk captured on the Blacktail Game Range tested seropositive for leptospirosis with a titer of only 1:50. Little is known about the immunologic features of this disease in wild mammals (Shotts 1981). More tests have to be done to understand what these results mean, but it may simply indicate that the elk have been exposed to the disease and have developed antigens against it (Dr. Bill Quinn, personal communication). Seven elk from this game range also had suspect reactions to anaplasmosis while tests from the Madison-Wall Creek elk showed 6 positive and 3 suspect reactions to anaplasmosis.

The complement-fixation test used to diagnose anaplasmosis in cattle results in a high incidence of false positive tests when applied to wildlife species (Howe et al. 1964, Howe and Hepworth 1965, Vaughn et al. 1973, Jacobson et al. 1977). Howe et al. (1964)

and Vaughn et al. (1973) reported that 55% and 60%, respectively, of the elk they sampled gave false positive or suspect reactions. However, Howe et al. (1964) were unable to experimentally transmit anaplasmosis from these elk to calves or sheep. These studies suggest that our positive and suspect reactors were the result of the diagnostic test's limitations rather than representing infected animals.

Elk Distribution

The collective distribution of 138 elk marked on or near the Madison-Wall Creek Game Range during the winters of 1984 and 1985 were plotted and a herd home range calculated for five time periods using the computer program TELDAY (Wildlife Div., MDFWP 1986). Most of these relocations were from radio marked elk. Marked neonates were not used in this analysis, since some of these may have been from cows not wintering on or near the Madison-Wall Creek Game Range. The time periods were identified as one continuous (March 1, 1984 to June 30, 1986) and four seasonal; winter (December 1 to February 28 for 1984-85 and 1985-86), spring (March 1 to May 31 for 1984, 1985 and 1986), summer (June 1 to August 31 for 1984 and 1985), and fall (September 1 to November 30 for 1984 and 1985).

Overall Herd Home Range

The continuous time period relocations were distributed over an area of approximately 6,245 km^2 (2,410 mi^2). This involved 1,395 relocations including the capture sites. Relocations were distributed over several Montana hunting districts and overlapped into Idaho (Fig. 3). The elevational range of these relocations was 5,500 to 10,000 feet with a mean of 7,285 (± se 28.2). Some relocations of four young elk which dispersed well into Idaho were excluded from this calculation because their inclusion would have almost doubled this herd home range size. These included two cows (a yearling and a 2 1/2 year old when marked) and 2 bulls (a calf and a yearling when marked). The three yearling or older animals all dispersed the summer after they were marked (as 2 or 3 year olds), while the male calf returned to the Madison-Wall Creek Game Range the following winter (as a yearling) before dispersing as a 2 year old. A yearling bull marked on the Madison-Wall Creek Game Range in March, 1984 also dispersed and was killed during the 1984 hunting season in Montana hunting district 320. This relocation was not excluded from herd home range calculations since he did not leave the state. A few animals considered as dispersers remained within the overall study area.

Winter Herd Home Range

Although there are a few major wintering areas for elk in and adjacent to the study area, elk may be widely scattered during early winter. The amount of this early winter scatter is largely dependent on temperature and snow conditions. Herd home range size during this time is also influenced by elk changing wintering areas. To date 11 elk that were marked on the Madison-Wall Creek Game Range have wintered elsewhere in subsequent years (Table 3).

Winter herd home range size was 3,762 km^2 (1,452 mi^2) based on 314 relocations (Fig. 4). The elevational range was 5,800- 8,800 feet with a mean of 6,511 (se ± 25.6).

Spring Herd Home Range

Elk appeared to be less scattered during this time period than any of the others with a polygon area of 3,012 km^2 (1,163 mi^2) based on 430 relocations (Fig. 5). The elevational range was 5,500 to 9,100, feet with a mean of 6,640 (se ± 40). Elk were mostly concentrated on or near wintering areas during this time. A slow dispersal toward summer range occurs during March-May.

Table 3. History of elk marked on the Madison-Wall Creek Game Range (MWCGR) which wintered elsewhere in subsequent winters.

		WINTER				
		1983-84	1984-85		1985-86	
Sex	Age When Marked	Area Where Wintered	Area Where Wintered	Distance (Km) and Direction from trap site	Area Where Wintered	Distance (Km) and Direction from trap site
F	1.5	Marked MWCGR	Centennial Valley	40 SW	Blacktail Game Range	44 W
F	2.5	Marked MWCGR	Idaho	105 S	(DEAD)	---- ----
F	3.5	Marked MWCGR	Blacktail Game Range	44 W	(DEAD)	---- ----
F	7.5	Marked MWCGR	Centennial Valley	40 SW	Blacktail Game Range	44 W
F	8-10	Marked MWCGR	MWCGR	0	Lower Ruby River	23 W
F	0.5	------------	Marked MWCGR	---- ----	Robb-Ledford	35 W
F	0.5	------------	Marked MWCGR	---- ----	Lower Ruby River	23 W
F	0.5	------------	Marked MWCGR	---- ----	Lower Ruby River	23 W
F	0.5	------------	Marked MWCGR	---- ----	West Side Greenhorn Mtns.	26 W
F	4.5	------------	Marked MWCGR	---- ----	NE Side Greenhorn Mtns.	13 N
M	1.5	------------	Marked MWCGR	---- ----	Blacktail Ridge	62 W

Summer Herd Home Range

Elk were well distributed during this season with an overall herd home range size of 3,866 km^2 (1,492 mi^2) based on 405 relocations (Fig. 6). Elevational range was 6,300 to 10,000 feet with a mean of 8,257 (se ± 37.7).

Fall Herd Home Range

The distribution of relocations was greatest for this season with a polygon area of 4,161 km^2 (1,606 mi^2) based on 201 relocations (Fig. 7). Elevations ranged from 6,200 to 9,500 feet with a mean of 7,750 (se ± 61). The greatest distance moved by any of the marked elk from the Madison-Wall Creek Game Range occurred during this season. A 2 1/2 year old cow (not included in the above polygon area calculation), marked in late February, 1985 was found 5 miles east of Driggs, Idaho on September 20, 1985 about 100 air miles south of where she was marked. A flight on April 7, 1986 relocated her in about this same area with no sign of her being alive. She is apparently either dead or has shed her collar.

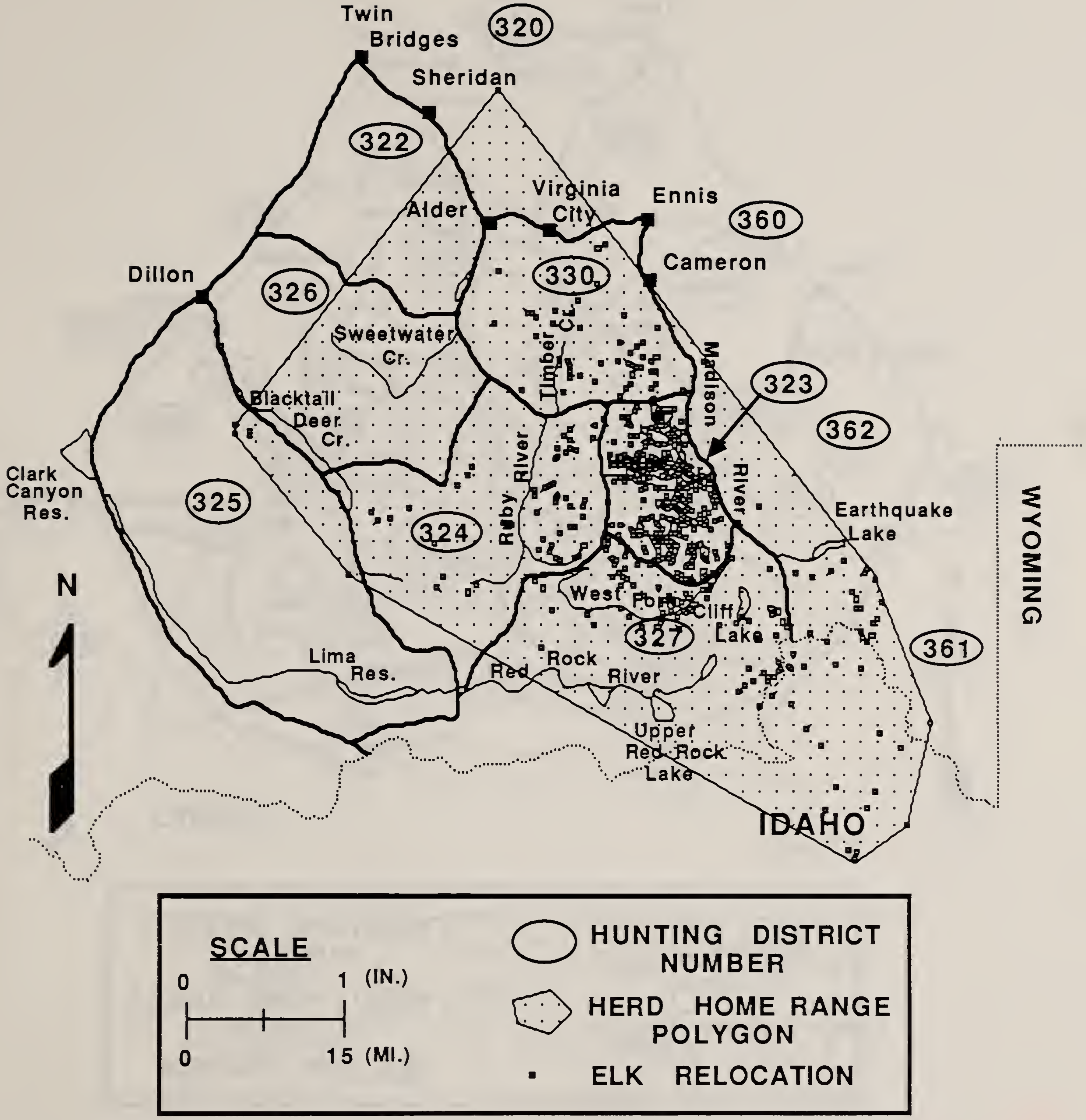

Figure 3. Relocations and herd home range polygon from 138 elk marked on or near the Madison-Wall Creek Game Range and tracked from late March, 1984 through June, 1986.

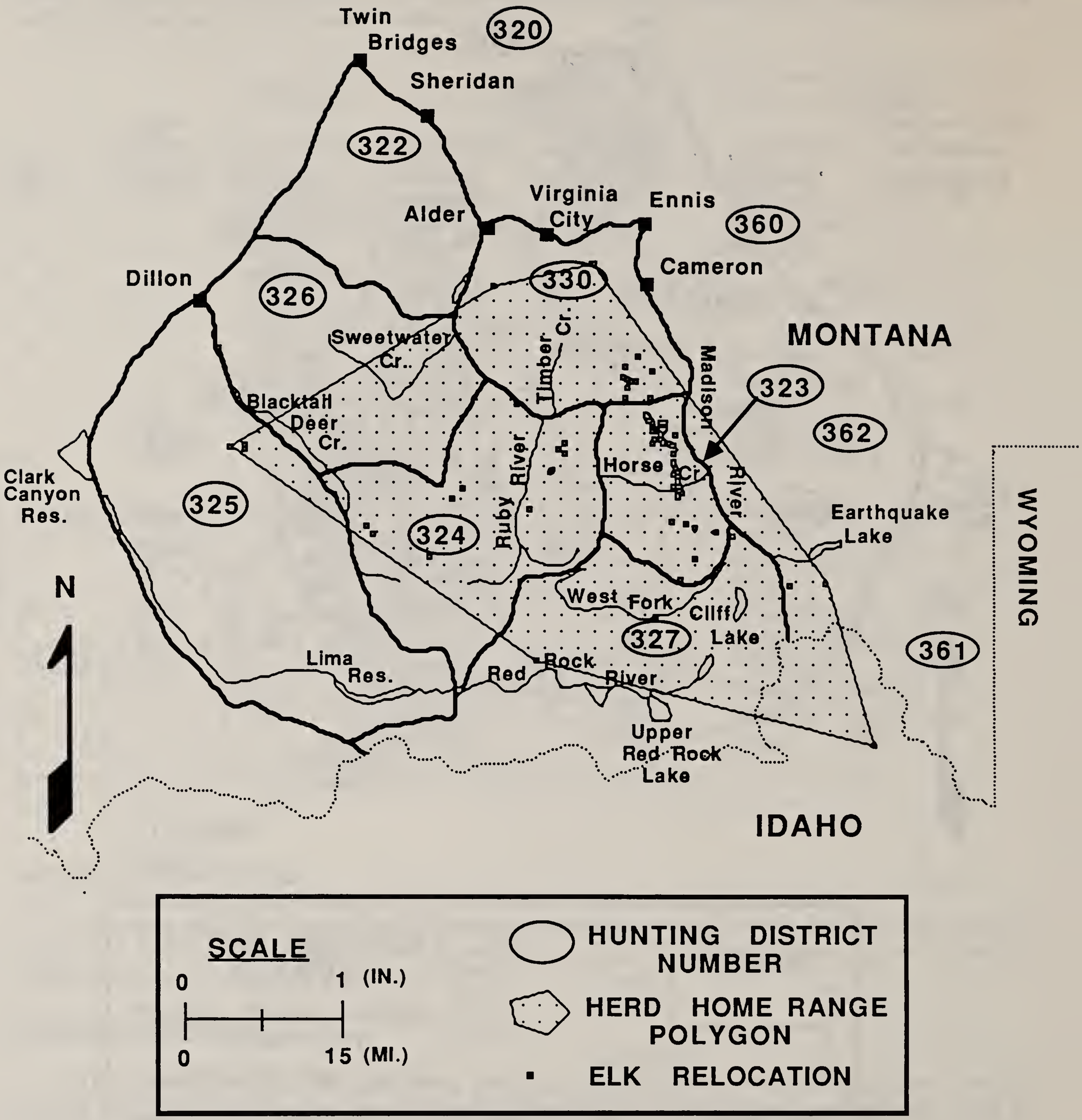

Figure 4. Relocations and herd home range polygon from elk marked on or near the Madison-Wall Creek Game Range for the winters (December 1 to March 1) 1984-85 and 1985-86.

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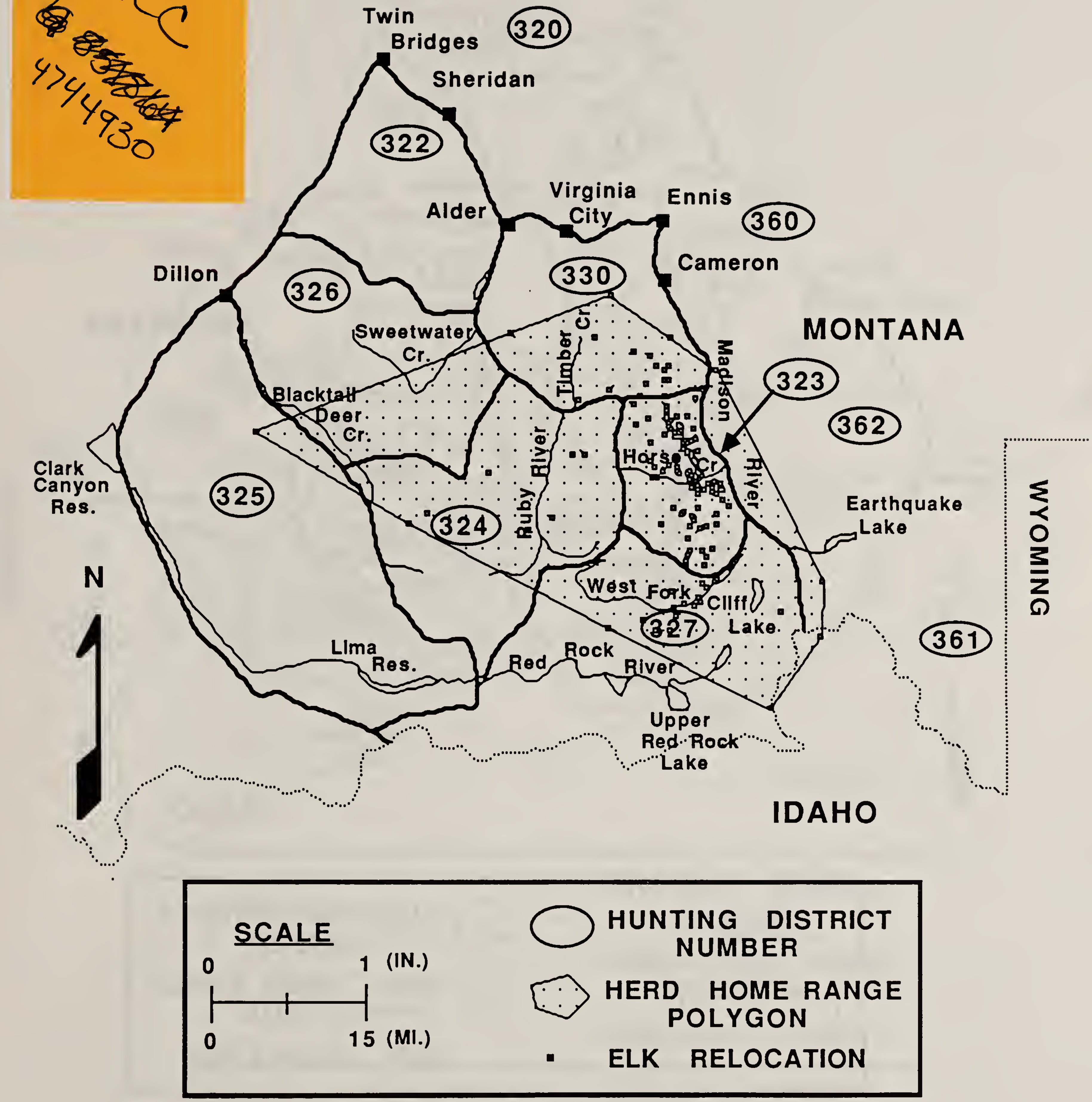

Figure 5. Relocations and herd home range polygon from elk marked on or near the Madison-Wall Creek Game Range for the spring season (March 1 to May 31) 1984, 1985 and 1986.

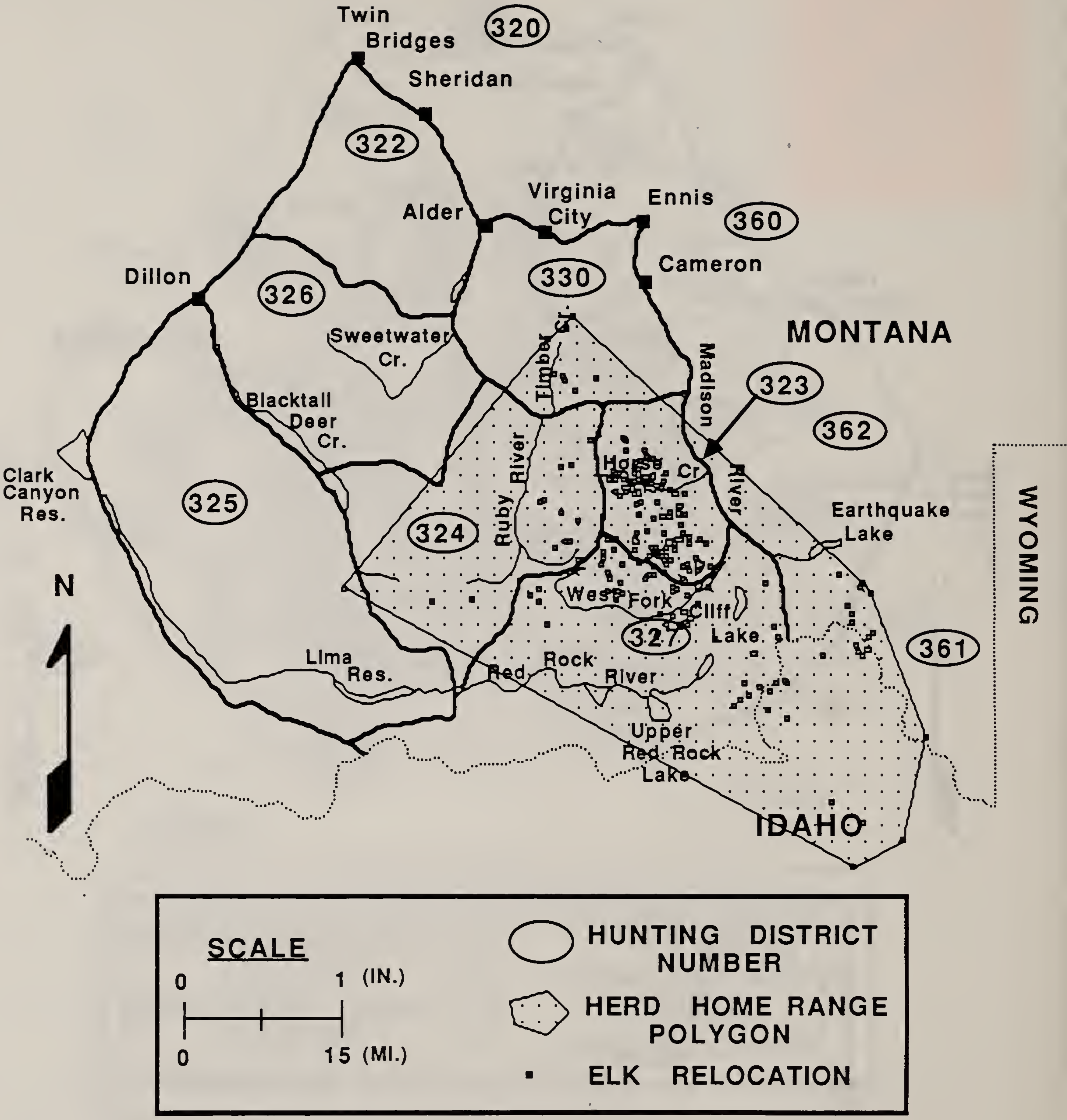

Figure 6. Relocations and herd home range polygon from elk marked on or near the Madison-Wall Creek Game Range for the summer season (June 1 to August 31) 1984 and 1985.

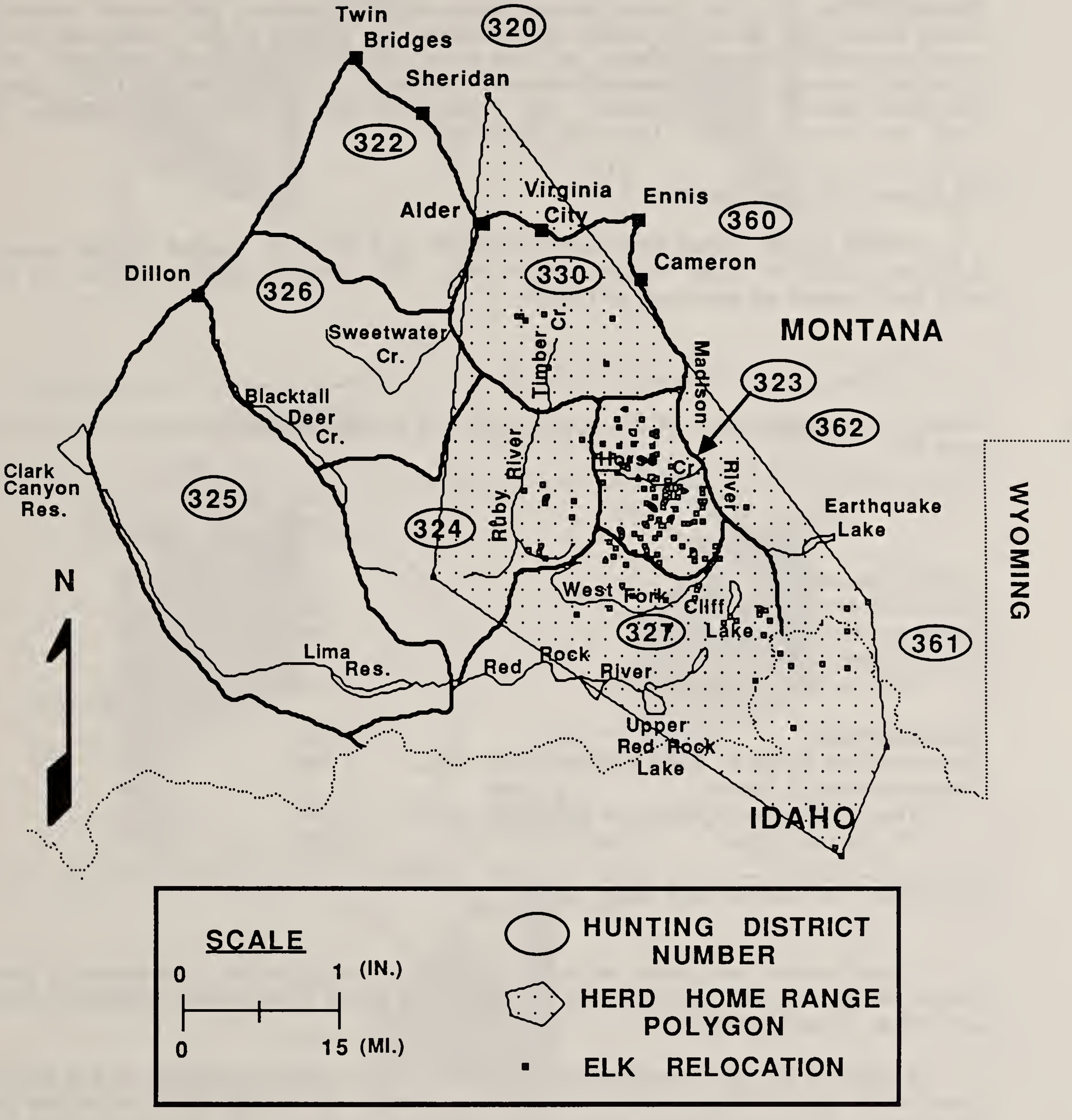

Figure 7. Relocations and herd home range polygon from elk marked on or near the Madison-Wall Creek Game Range for the fall season (September 1 to November 30) 1984 and 1985.

Relocations by Hunting District

The distribution of relocations for these same time periods was tallied by hunting district. The results are illustrated in Figure 8. Relocations predominantly occurred in Hunting District 323, the hunting district where trapping occurred, and ranged from 69% during summer and fall to 88% during spring. Seventy-six percent of the relocations for the continuous time period occurred in this hunting district. The second and third most important hunting districts by time period were: winter - 330 (10%) and 324 (4%); spring - 330 (22%) and 327 (20%); summer - 327 (18%) and 324 (5%); fall - 327 (13%) and 324 (7%); and continuous - 327 (10%) and 330 (5%).

Elk Census and Classifications

Census flights during the winters of 1984-85 and 1985-86 resulted in total counts of 2,908 and 3,037 for these winters, respectively. The general locations where elk were seen and counted are presented in Table 4.

Table 4. General locations of elk observations and counts for the winters of 1984-85 and 1985-86.

	1984-85	1985-86
Axolotl Lake Area	33	90
Cherry-Morgan Creeks Area	414	150
Madison-Wall Creek Game Range	664	805
Missouri Flats	---[a]	35
Total for east side of Gravellys	1,111	1,080
Centennial Valley	57	19
Blacktail Game Range & Robb-Ledford Creeks Area	1,740	1,689
Greenhorn Mtns. & vicinity	---	249
Total for Blacktail-Centennial- Greenhorn Area	1,797	1,957
Overall Total	2,908	3,037

[a] No flights over this area were made.

Classifications were made whenever possible to determine the percentage of calves present and to note any changes in the proportion of calves which would indicate the timing and extent of calf mortality.

Summer, 1985, elk classifications included 1,078 animals classified in July and 350 classified in August with the aid of a fixed wing aircraft, and 99 classified during July from the ground. All classifications were made in hunting districts 323, 324, 327, and/or 330. Because some yearling bulls have very short antlers at this time of year, they cannot be reliably distinguished from cows except under the most favorable conditions. Therefore, calf/cow + spike ratios are used for these observations. These ratios were 49.7, 34.0, and 41.5 calves per 100 cows and spikes for the two fixed wing flights and ground observations, respectively. Calves comprised 32, 27, and 27 percent, and branch antlered bulls 3, 7, and 5 percent, of the total for each data set, respectively. These figures are quite consistent with those from 1984, when 1,462 and 882 elk were classified from the air and ground, respectively (Table 5).

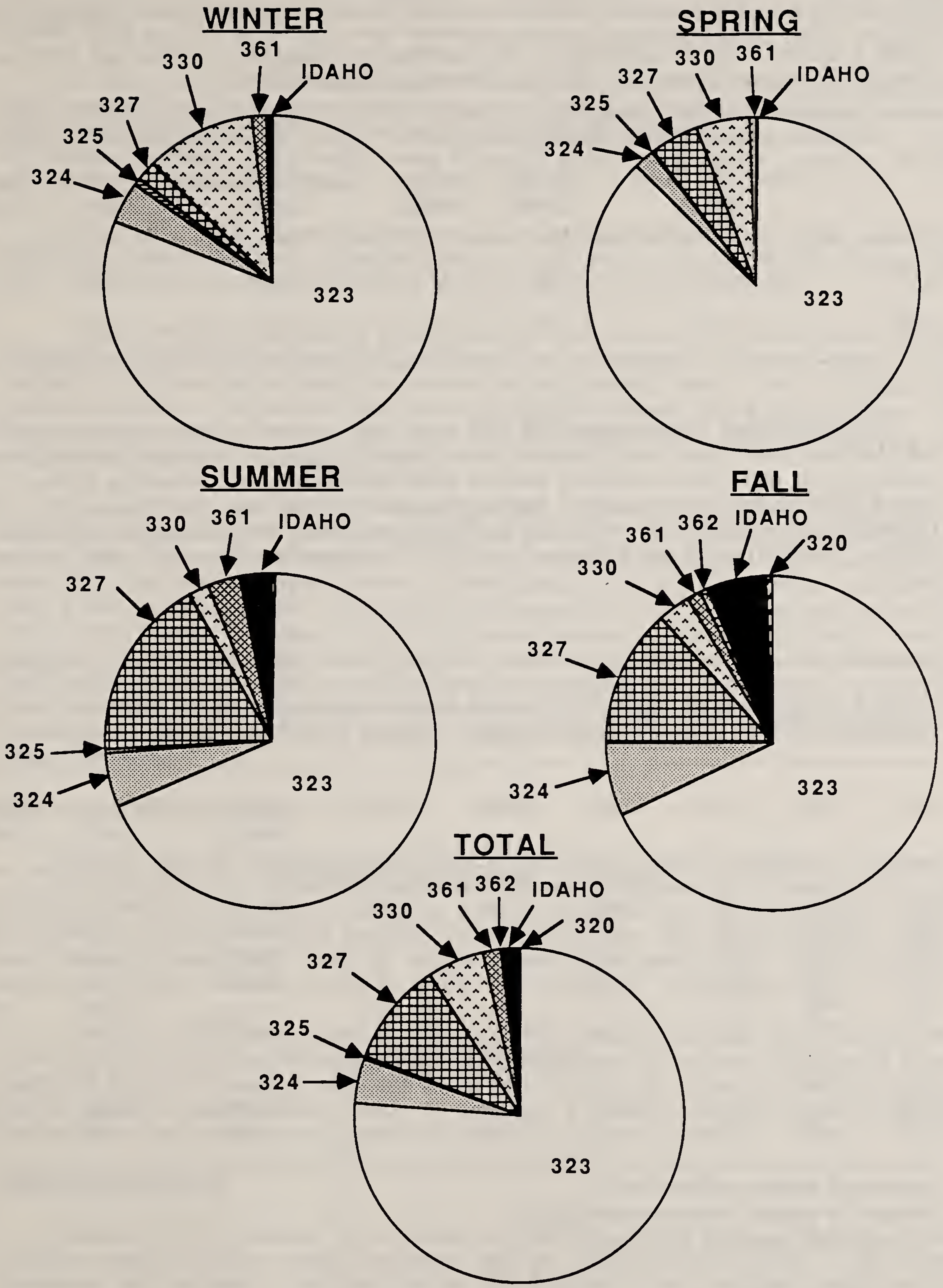

Figure 8. Seasonal proportions (%) to date of relocations for elk marked on the Madison-Wall Creek Game Range in 1984 and 1985 within several Montana Hunting Districts and Idaho.

Table 5. Comparison of classification data between the summers of 1984 and 1985 for the Gravelly-Snowcrest Mountains. (BABS = Branch-Antlered Bulls)

	From the Air (July)			From the Ground		
	Calves/100 Cows + Spikes	Percent Calves	Percent BABS	Calves/100 Cow + Spikes	Percent Calves	Percent BABS
1984	44.2	30	2	43.5	30	2
1985	49.7	32	3	41.5	27	5

Classifications during winter 1985-86 were done primarily from the ground on both the Madison-Wall Creek and Blacktail Game Ranges. Calf/cow ratios and the proportion of antlered bulls and branch-antlered bulls in these observations are shown in Table 6. The winter 1985-86 figures for antlered and branch-antlered bulls on the Madison-Wall Creek Game Range are similar to, while the calf/cow ratio was only about half, that found the previous winter (Lonner and Schladweiler 1985). The reduced calf/cow ratio will be discussed later.

Table 6. Classification results from ground observations of elk on the Madison-Wall Creek and Blacktail Creek Game Ranges during the winter of 1985-86 and spring, 1986.

Date	Total	Cows	Calves	Spikes	BABS	Calf/Cow Ratio	Percent AB[a]	Percent BAB[b]
Madison - Wall Creek Game Range								
2/12	616	397	160	52	7	40/100	10.0	1.0
2/12	242	156	65	19	2	42/100	9.0	1.0
2/13	195	116	57	19	3	49/100	11.0	1.5
2/14	426	300	97	25	4	32/100	7.0	1.0
2/14	566	----	---	46	10	---------	10.0	1.8
4/29	372	259	106	7	0	41/100	2.0	0.0
Blacktail Game Range								
2/13[c]	528	----	---	75	14	---------	15.0	2.4
2/20	663	435	157	66	5	36/100	11.0	1.0
2/21	440	257	147	36	0	57/100	8.0	0.0

[a] percent of sample antlered bulls
[b] percent of sample branch-antlered bulls
[c] classification made by H. Chrest

No comparable classifications were obtained on the Blacktail Game Range in 1984-1985.

During a late February, 1986, flight covering the Greenhorn Mountains and west slope of the Snowcrest Mountains, 341 elk were classified. This resulted in a calf/cow ratio of 39/100; 10% and 1.2% of the total were antlered and branch-antlered bulls, respectively.

A flight was made in early April, 1986 over the Greenhorn Mountains, lower Ruby River, west side of the Snowcrest Mountains and north side of the Centennial Valley west of Fish Creek. Elk on and adjacent to the Blacktail Game Range were not classified. A total of 935 elk were seen, 457 of which were in groups which were totally classified, resulting in a calf/adult ratio of 24/100.

Late April, 1986, ground observations of elk on the Madison-Wall Creek Game Range resulted in a total of 372 elk classified with a calf/adult ratio of 40/100. Similar April, 1985, observations totaled 387 animals with a calf/adult ratio of 67/100.

These classifications indicate good production and survival of calves in this area, and corroborate production and survival indicated by pregnancy tests and radio tagged neonates. Calf/cow ratios during the winter and early spring months also indicated good survival of calves. The low calf/adult ratio of 24/100 observed during the early April, 1986 flight over the west side of the study area could be more a result of sampling than indicative of high over winter calf mortality.

The lowered calf/cow ratio noted on the Madison-Wall Creek Game Range in 1985-86, compared to the previous winter, was close to what would be considered a normal value. Two possible explanations for these widely divergent ratios between years exist. The first is that sampling errors in 1984-85 led to the high ratio noted that year. The other is that the 1984-85 ratio was correct (see discussion of this in Lonner and Schladweiler 1985), which means that nearly half of the cows present in winter 1985-1986 would be unproductive yearlings. This would obviously lower the calf/cow ratio in that winter and to some extent in the next year as well because the pregnancy rate of yearlings is appreciably lower than that of older cows (see Figure 2). Future observations and analysis of elk population dynamics should help identify causes for abnormally low or high calf/cow ratios when they occur.

Mortality of marked animals

Known fate of marked neonatal calves has already been discussed. Nineteen of 74 (26%) elk marked in late March, 1984, were known to be dead by 30 June, 1986. These included a female calf found caught in a fence approximately 1 month after marking, 17 taken by hunters, 8 during the 1984 and 9 during the 1985 hunting season, and an adult female that apparently died of natural causes in late spring 1985. The 1985 hunting season mortalities included one cow which was apparently a crippling loss.

Four of 67 (6%) elk marked in February, 1985 were known dead by 30 June, 1986. These included a yearling bull which died of natural causes in summer, 1985, and 3 taken by hunters in the 1985 hunting season (a 2 1/2 year old bull and 2 cows). One of the latter was an apparent crippling loss in Idaho. In addition, 2 female calves are known to have shed their radio collars and a yearling cow either shed its collar or is dead.

Check Station Results

Hunter check stations were primarily operated at 3 locations during the 1985 hunting season. Check station locations were on main access routes to the Gravelly Mountains and included the West Fork of the Madison River, McAtee Bridge, the Ruby River, and the Call Road (opening weekend only). Check stations were operated the first 2 days of the season (Sunday and Monday) and each weekend thereafter from mid morning until approximately 1 hour after dark, depending on the amount of traffic. These check stations intercept hunters from hunting districts 323, 324, 327, and 330 or a combination of these districts. Results obtained from these check stations for the 1985 hunting season are presented by weekend and hunting district in Table 7 and are summarized for the 1984 and 1985 hunting seasons in Figures 9 and 10. Although all hunters, parties, and hunter days are reported, only elk observations and checked elk kills are presented. A few animals checked in the field are not included in Table 7 because the lack of corresponding hunter effort would tend to bias the results.

Table 7. A summary of elk hunting statistics from 3 check stations operated in the Gravelly-Snowcrest Mountains during the general hunting season in 1985.

		HUNTERS CHECKED				ELK OBSERVATIONS			ELK CHECKED		
Date	Hunting District	Total	Number of Parties	Hunters per Party	Hunter days Effort	Percent of Parties Observing Elk	Elk Observed per Hunter	Elk Observed per Hunter Day	Total	Elk per Hunter	Hunter Days per Elk
27-28 Oct.	323	255	121	2.1	319	39	1.6	1.3	11	0.043	29.0
	324	257	119	2.2	331	60	7.2	5.6	25	0.097	13.2
	327	154	57	2.7	189	58	17.2	14.0	38	0.247	5.0
	330	217	95	2.3	249	55	4.5	4.0	10	0.046	24.9
	323-27	0	——	.--	——	0	.--	.--	0	.——	.--
	323-30	0	——	.--	——	0	.--	.--	0	.——	.--
	Misc.	4	2	2.0	4	0	.--	.--	0	.——	.--
Weekend Total		887	394	2.3	1092	52	6.7	5.4	84	0.094	13.0
2-3 Nov.	323	135	58	2.3	394	45	1.6	0.5	7	0.052	56.3
	324	246	90	2.7	946	52	9.0	2.3	20	0.081	47.3
	327	51	17	3.0	175	47	9.6	2.8	8	0.157	21.9
	330	164	71	2.3	326	30	1.7	.9	7	0.043	46.6
	323-27	4	1	4.0	8	0	.--	.–	0	.——	.--
	323-30	0	-	.-	–	0	.--	.--	0	.——	.--
	Misc.	5	2	2.5	5	0	.0	.0	0	.——	.--
Weekend Total		605	239	2.5	1845	43	5.3	1.7	42	0.069	44.1
9-10 Nov.	323	166	71	2.3	235	35	2.3	1.6	6	0.036	39.2
	324	315	121	2.6	970	48	3.3	1.1	19	1.06	51.1
	327	33	12	2.8	51	33	.8	.5	3	0.09	17.0
	330	102	38	2.7	181	29	1.5	.9	2	0.02	90.5
	323-27	10	4	2.5	20	50	1.1	.5	0	.——	.--
	323-30	8	4	2.0	8	0	.--	.--	0	.——	.--
	Misc.	6	3	2.0	11	0	.--	.--	0	.——	.--
Weekend Total		640	253	2.5	1476	21	2.5	1.1	30	0.047	49.2
1st 1/2 Season	323	556	250	2.2	948	39	1.8	1.1	24	0.043	39.5
	324	818	330	2.5	2247	53	6.2	2.3	64	0.078	35.1
	327	238	86	2.8	415	52	13.3	7.6	49	0.206	8.5
	330	483	204	2.4	756	41	2.9	1.9	19	0.039	39.8
	323-27	14	5	2.8	28	40	.8	.4	0	.——	.--
	323-30	8	4	2.0	8	0	.--	.--	0	.——	.--
	Misc.	15	7	2.8	20	0	.--	.--	0	.——	.--
1st 1/2 Season	Total	2132	886	2.4	4422	46	5.0	2.4	156	0.073	28.3

Table 7. Continued.

		HUNTERS CHECKED				ELK OBSERVATIONS			ELK CHECKED		
Date	Hunting District	Total	Number of Parties	Hunters per Party	Hunter days Effort	Percent of Parties Observing Elk	Elk Observed per Hunter	Elk Observed per Hunter Day	Total	Elk per Hunter	Hunter Days per Elk
16-17 Nov.	323	150	63	2.4	232	27	1.4	0.9	4	0.027	58.0
	324	166	58	2.9	453	45	6.6	2.4	19	0.114	23.8
	327	36	18	2.0	44	11	0.6	0.5	0	.-----	.--
	330	103	40	2.6	210	15	0.4	0.2	3	0.029	69.8
	323-27	3	1	3.0	3	0	.--	.--	0	.-----	.--
	323-30	0	—	.--	——	0	.--	.--	0	.-----	.--
	Misc.	2	1	2.0	1	0	.--	.--	0	.-----	.--
Weekend Total		460	181	2.5	943	23	3.0	1.5	26	0.056	36.3
23-24 Nov.	323	133	59	2.3	228	31	1.6	0.9	5	0.038	45.6
	324	95	37	2.6	508	27	0.7	0.1	13	0.137	39.1
	327	25	13	1.9	66	39	0.6	0.2	1	0.04	66.0
	330	49	19	2.6	75	32	0.6	0.4	3	0.061	25.0
	323-27	0	–	.--	–	0	.--	.--	0	.-----	.--
	323-30	0	–	.--	–	0	.--	.--	0	.-----	.--
	Misc.	0	–	.--	–	0	.--	.--	0	.-----	.--
Weekend Total		302	128	2.4	877	38	1.0	0.4	22	0.07	39.9
30 Nov.-1 Dec.	323	79	35	2.3	143	37	4.5	2.5	3	0.038	47.5
	324	105	34	3.1	264	32	1.2	0.5	13	0.124	20.3
	327	14	6	2.3	24	50	0.9	0.5	2	0.143	12.0
	330	103	43	2.4	168	26	0.7	0.5	3	0.029	55.8
	323-27	0	—	.--	—	0	.--	.--	0	.-----	.--
	323-30	0	—	.--	—	0	.--	.--	0	.-----	.--
	Misc.	2	1	2.0	2	0	.--	.--	0	.-----	.--
Weekend Total		303	119	2.5	601	36	1.9	1.0	21	0.069	28.6
2nd 1/2 Season	323	362	157	2.3	603	31	2.1	1.3	12	0.033	50.2
	324	366	129	2.8	1225	37	3.5	1.1	45	0.123	27.2
	327	75	37	2.0	134	27	0.6	0.3	3	0.040	44.7
	330	255	102	2.5	452	23	0.6	0.3	9	0.035	50.2
	323-27	3	1	3.0	3	0	.--	.--	0	.-----	.--
	323-30	0	–	.--	–	0	.--	.--	0	.-----	.--
	Misc.	4	2	4.0	3	0	.--	.--	0	.-----	.--
2nd 1/2 Season Total		1065	428	2.4	2420	30	2.1	.9	69	0.065	35.1
Season Total	323	918	407	2.3	1551	36	1.9	1.1	36	0.04	43.1
	324	1184	459	2.6	3472	49	5.4	1.8	109	0.09	31.9
	327	313	123	2.5	549	45	10.2	5.8	52	0.17	10.6
	330	738	306	2.4	1804	10	2.1	0.9	28	0.04	64.4
	323-27	17	6	2.8	31	33	0.6	0.4	0	.----	.--
	323-30	8	4	2.0	8	0	.0	.0	0	.----	.--
	Misc.	19	9	2.1	23	0	.0	.0	0	.----	.--
Total		3197	1314	2.4	7438	35	4.1	1.7	225	0.07	33.1

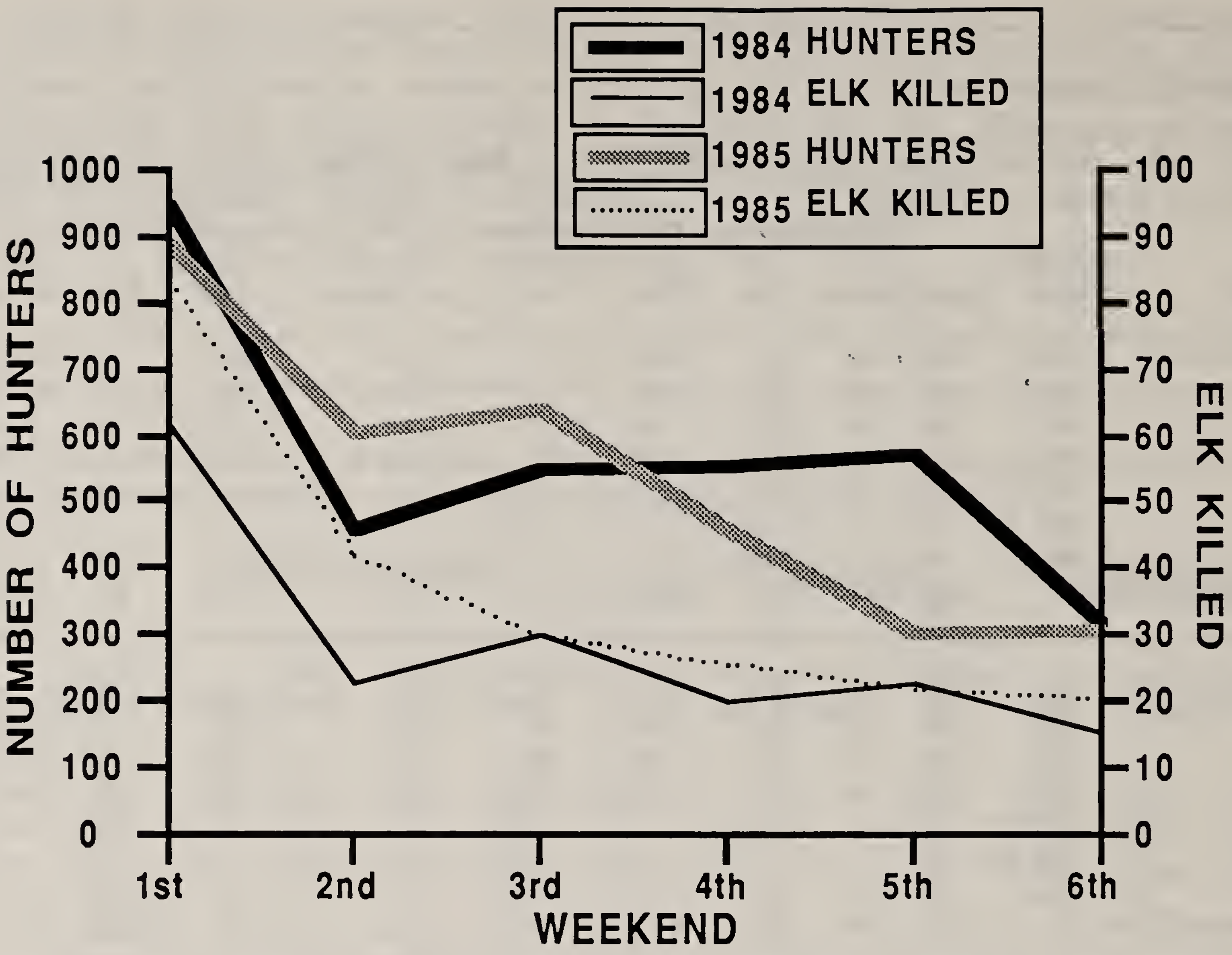

Figure 9. Hunter numbers and elk harvest from data recorded at check stations during the 1984 and 1985 big game hunting seasons in the Gravelly Mountains and vicinity.

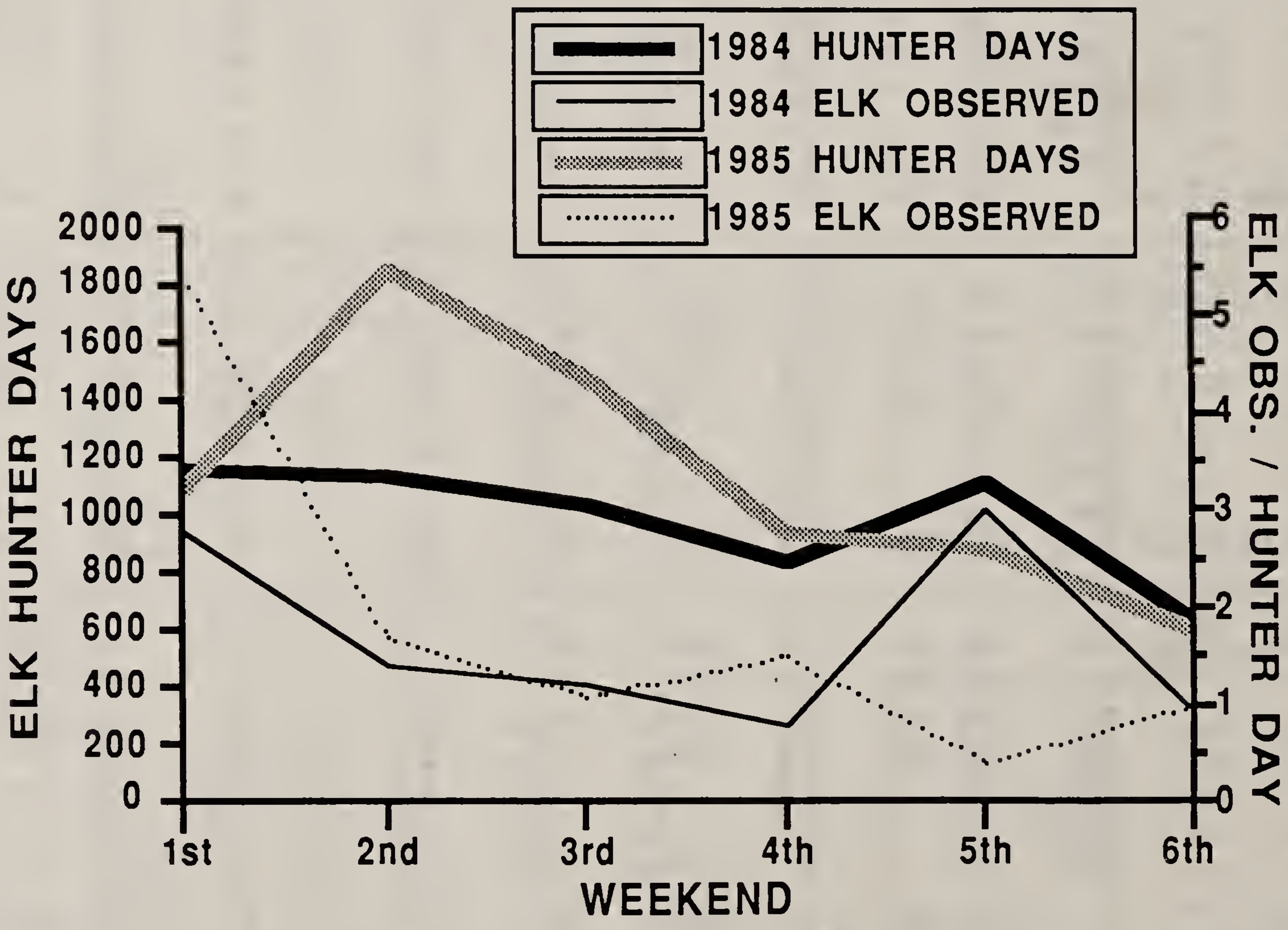

Figure 10. Hunting effort relationships from data recorded at check stations during the 1984 and 1985 big game hunting seasons in the Gravelly Mountains and vicinity.

Overall, nearly 3,200 hunters checked spent over 7,400 days hunting and bagged 225 elk. These figures for 1984 were 3,400, 5,900, and 174, respectively (Lonner and Schladweiler 1985). Most hunters, effort, and elk checked were from hunting district 324 for both years.

The greatest number of hunters checked (28% of the season total for both years), elk checked (36% in 1984 and 37% in 1985) occurred on the first 2 days of the season. In 1984, the greatest number of hunting days of effort (20%) occurred during this time, but in 1985 the second weekend accounted for the most hunting effort (25%) for any single weekend. In 1984 the first half of the season accounted for 57% of the hunters and 56% of the hunter days of effort but 66% of the checked elk harvest. These figures for 1985 were 67%, 59%, and 69%, respectively.

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Statewide harvest survey figures indicate a total harvest of 1,336 and 1,234 elk in 1984 and 1985, respectively for hunting districts 323, 324, 327, and 330. Our check stations checked 174 and 225 elk through them for 1984 and 1985, respectively. Forty and 36% of the total harvest figures from the harvest survey were antlered bulls for 1984 and 1985, respectively, while these percentages from our check stations were 41 and 47%. Three of these 4 hunting districts were open to branch-antlered bulls only. Hunters reported taking 267 and 220 branch-antlered bulls (4 points or better) and 268 and 222 yearlings (3 points or less) in 1984 and 1985, respectively. Therefore, according to the statewide harvest survey results, 50% of the antlered harvest was 3 points or less in both 1984 and 1985. The number of antlered-bulls checked through our check stations for these years were 72 and 107, with 40% and 43% of these bulls with 3 points or less for 1984 and 1985, respectively.

Although this survey has an 80% confidence level and about 20% of the yearling bulls are legal under the branch-antlered regulation, the figure for yearlings still seems to be too high. Similarly, the harvest survey indicated that the antlerless harvest in these 4 hunting districts was comprised of nearly 8 and 6 cows for every calf in 1984 and 1985, respectively, whereas this ratio from our check station figures was 3:1 in both years.

In either case, the differential harvest of cows versus calves would result in a higher post-season calf:cow ratio than was present prior to the hunting season. Discrepancies were again noted between the two data sets in the number of hunting days per elk bagged in three of these 4 hunting districts. In each of these 3 cases , the check station data gave figures 1.6 to 3.2 times higher than those from the harvest survey in 1985. In 1984, check station data gave figures 1.4 to 1.9 times higher (Lonner and Schladweiler 1985).

Thus far, out of 177 antlered bulls checked in 1984 and 1985, 20% have been yearling spikes (1 X 1 points) and 80% branch-antlered (2 X 1 points or more). A further breakdown of these bulls is presented in Figure 11. Based on bulls checked through the check stations in both of these years, it appears that few bulls live beyond 4 1/2 years, although there is a slight trend that more bulls are living beyond 3 1/2 years (Fig. 12).

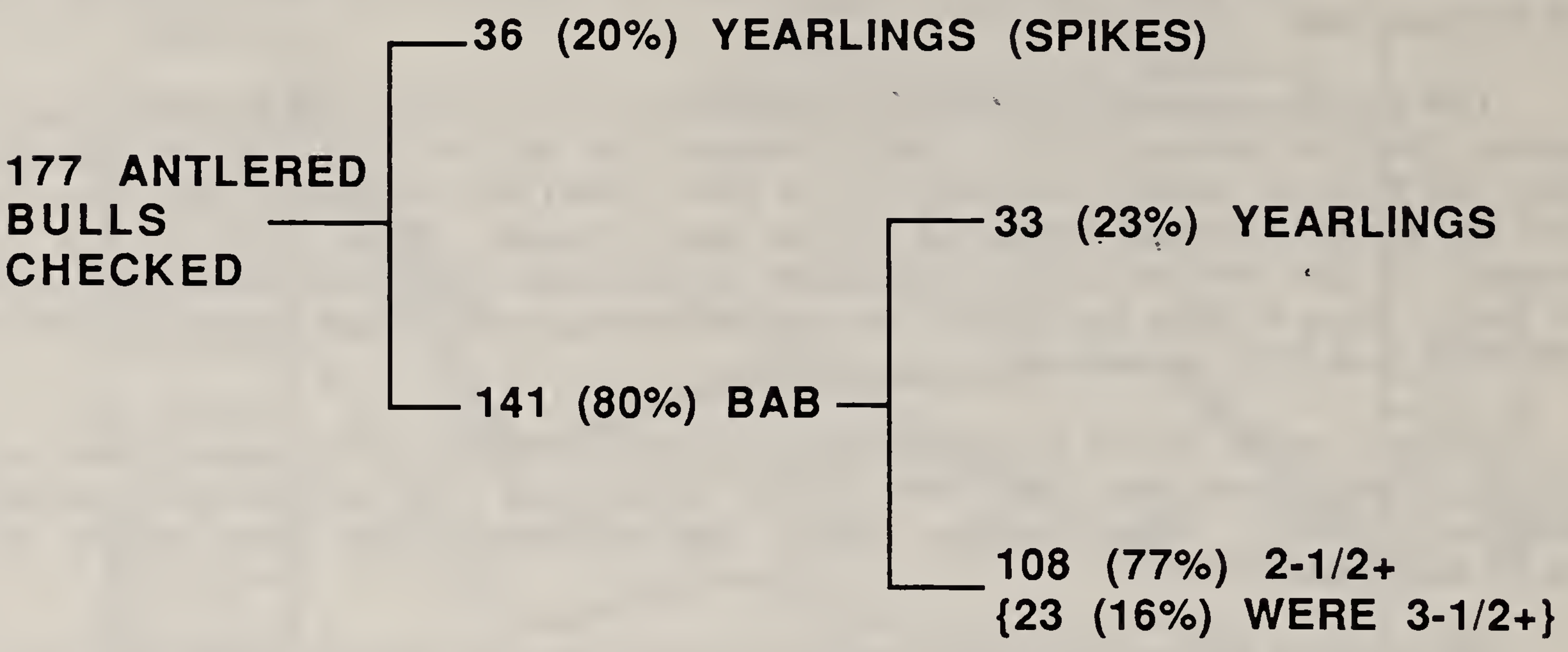

Figure 11. General breakdown of the antlered elk checked in the Gravelly area during the 1984 and 1985 general hunting season. (BAB = branch-antlered bull)

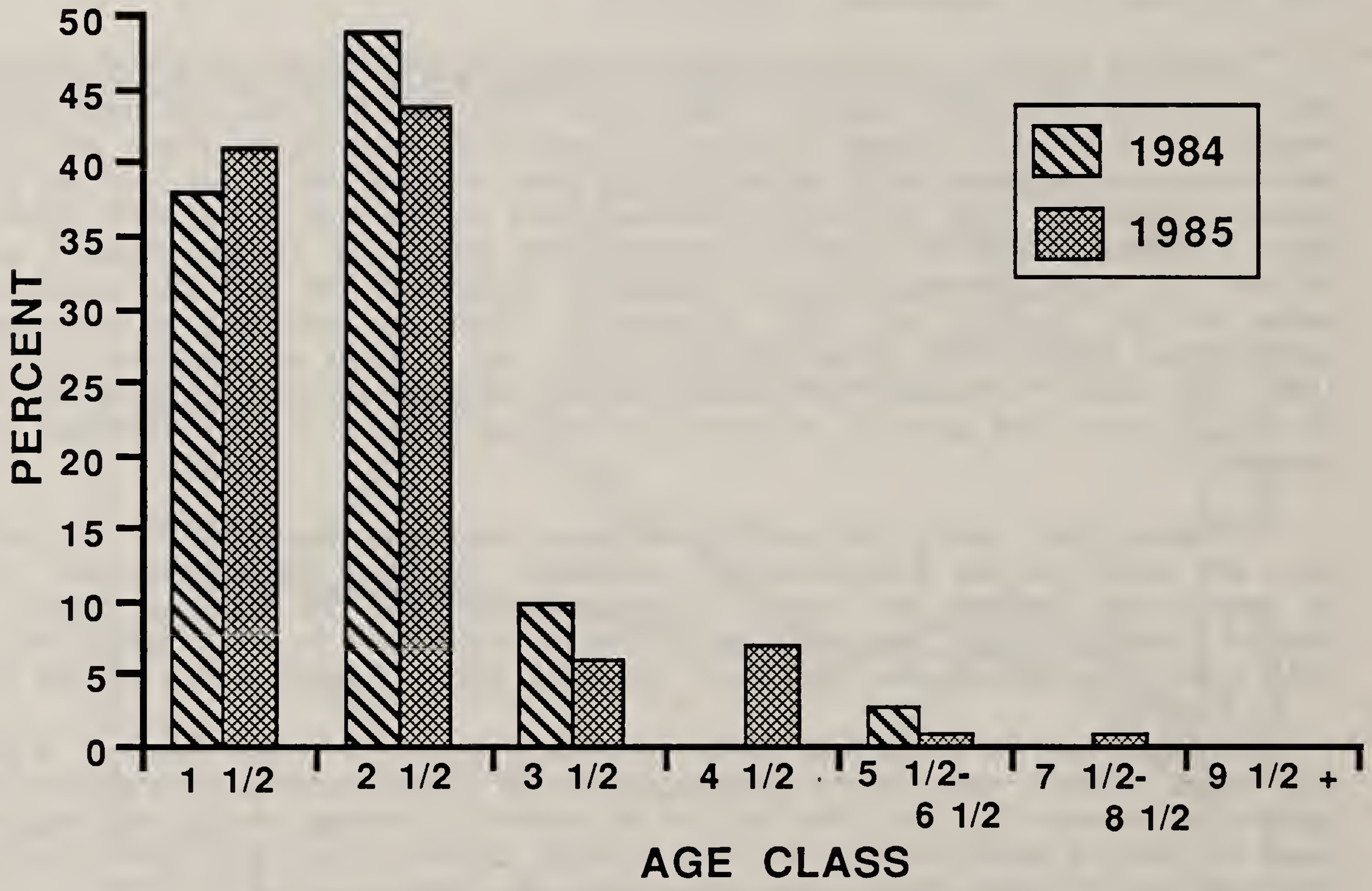

Figure 12. Age class distribution of antlered elk checked in the Gravelly area during the general hunting season in 1984 and 1985.

The age distribution of the antlerless kill is presented in Figure 13. Similar proportions for the age classes existed in 1984 and 1985, except for the 3 1/2 year olds, where they made up only 2% of the harvest in 1984, but 9% in 1985. Results from aging an additional 153 antlerless elk from the jaw tag returns in 1985 indicated that the check station data might have been somewhat inflated for this age class (Fig. 14). Check station results showed 9 % of the antlerless harvest 3-1/2 year olds whereas jaw tag returns showed this to be 5%. Combining the age breakdown of antlerless elk from the check stations with that from the jaw tag returns in 1985 still indicated that this age class had the lowest proportion for those elk aged to the nearest year (Fig. 14). The reason for this low proportion of 3-1/2 year old antlerless elk in both of these years is unknown at this time.

Elk calves were weighed at the check stations as an attempt to evaluate their condition and get an idea as to the approximate times of birth and, hence, conception dates. Twenty-nine calves have thus far been weighed. This small sample size precludes a good interpretation of these data at this time. Calves will continue to be weighed during future years of this study, which will increase this sample size and allow a good analysis of these data.

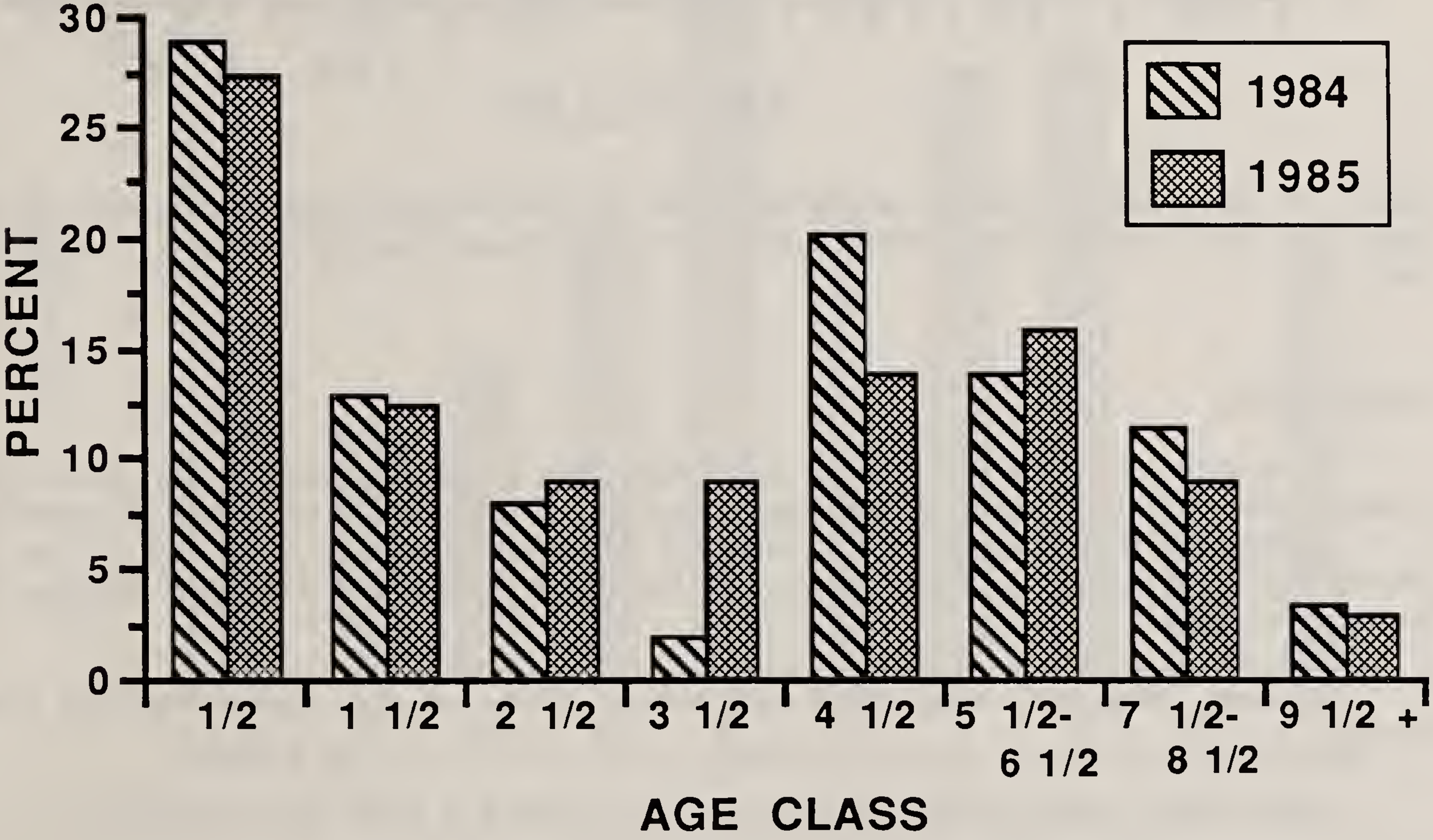

Figure 13. Age class distribution of antlerless elk checked in the Gravelly area during the general hunting season in 1984 and 1985.

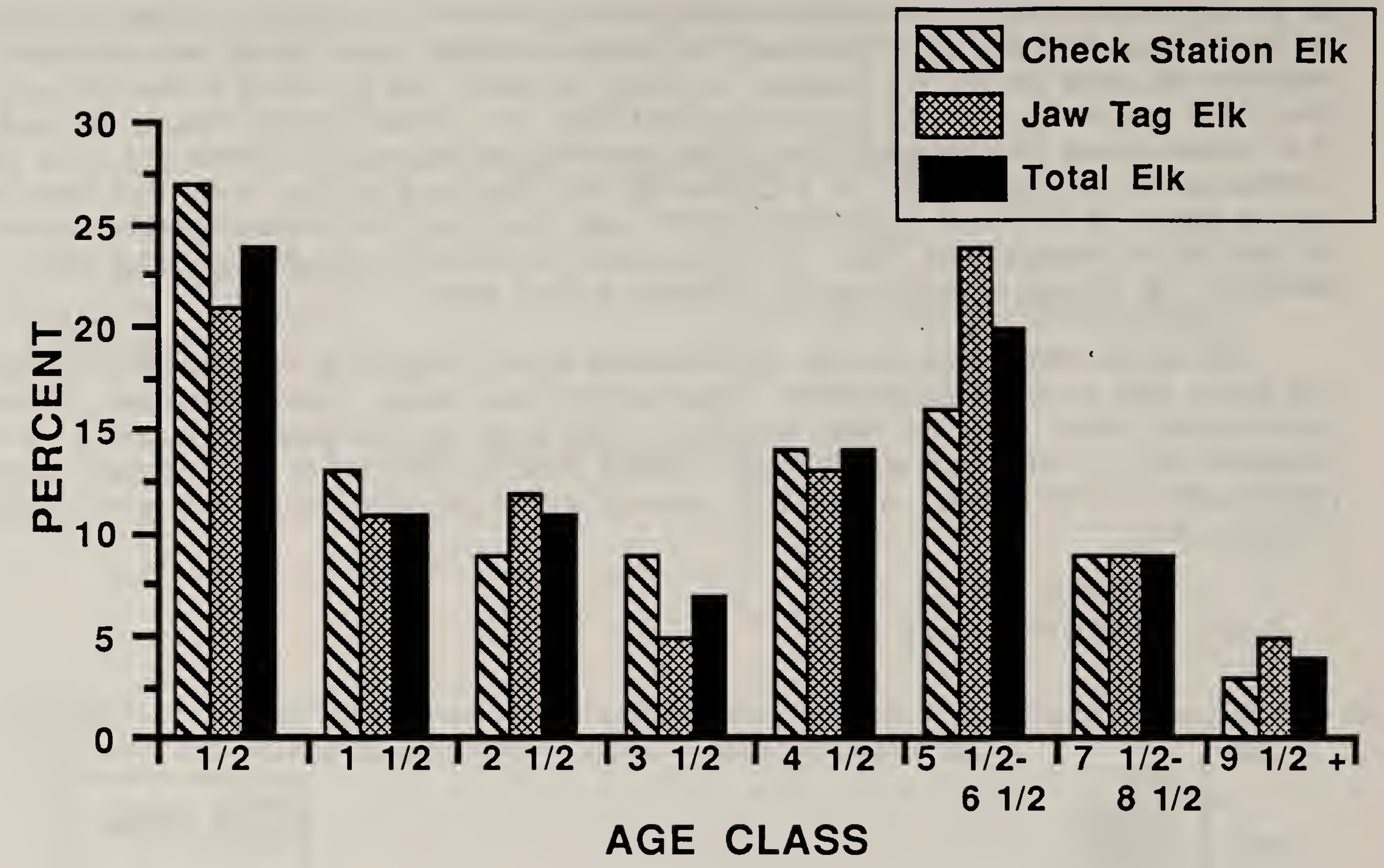

Figure 14. Age class distribution among antlerless elk aged at check stations compared to those aged from jaws turned in by hunters during the 1985 general hunting season in the Gravelly area.

Hunter survey

A survey of hunter demand and satisfaction was conducted during the fall of 1984. Hunters were randomly asked at the check stations if they would be willing to participate in a survey and if they agreed their name and address was taken. As a result of this process 465 questionnaires were mailed in December, 1984 and 279 were returned for a response of 60%.

Nineteen questions were asked each hunter. Some of the results from this survey follow:

Ninety-eight percent of the hunters were male, and 88 % were from Montana.

Ninety-four percent hunted in hunting districts 322, 323, 324, 326, 327, or 330.

Less than 5% said they used outfitter services.

When asked if they archery hunted in the area, 90% said NO and 10% said YES. When asked if hunters should be forced to choose between participating in the archery season or the rifle season, but not both, 70% said NO and 30% said YES. Interestingly, 69% of those that said they didn't archery hunt in the area still said NO to this question, while 89% of those who said they did archery hunt in the area said NO to this question.

Twenty percent said they had killed an elk during the 1984 hunting season. All hunters were asked if they were satisfied with killing any elk regardless of age, sex or antler size; 52 % said NO and 48 % said YES.

The following responses were based on the hunting district in which hunters reported they hunted most in 1984.

When asked to rate the 'quality' of their 1984 hunting experience using a scale of 1 (poor) to 10 (excellent), with 5 being "OK", sixty-nine percent of the respondents ranked their hunt from 5 to 10, while 49% ranked it from 1 to 5 (Fig. 15). For those hunters who had killed an elk, these percentages were 96 and 17, respectively and for those hunters that didn't kill an elk they were 62 and 57, respectively. Seventy-five percent of the hunters that hunted primarily in a hunting district with any antlered bull legal said their hunting experience ranked 5 to 10 while this proportion was 69% for those that hunted in an area with branch-antlered bulls only legal.

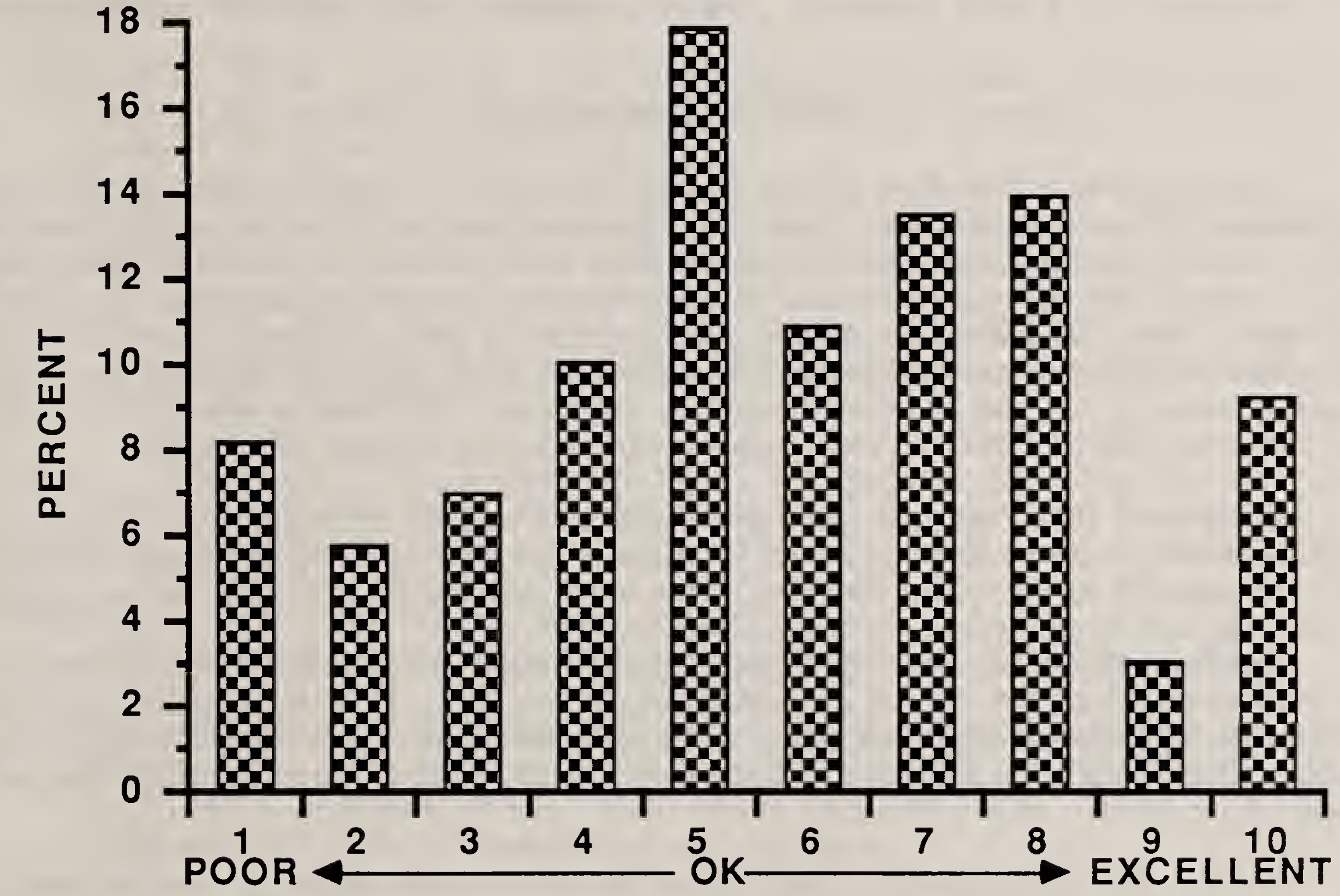

Figure 15. A breakdown of the response by hunters in ranking the quality of their 1984 hunting experience in the Gravelly area.

When asked if satisfied with existing elk hunting regulations, 30 % said NO and 70% said YES. For those that answered this question YES, 76% ranked their hunting experience 5 to 10 (OK to excellent), while for those that answered this question NO, 54% ranked their hunt OK to excellent.

Also relative to this question, they were asked if they would support the following regulation change: Permit required to kill a branch-antlered bull, any spike elk legal to all licensed elk hunters, and permit required to shoot antlerless elk.

Fifty-nine percent said they were not in favor of this, 39% were in favor and 2% indifferent.

When asked if they were satisfied with the current opportunity to see branch-antlered bulls 41% said NO and 59% said YES. The response of this question for hunters that hunted in an area with any bull legal vs. an area with branch-antlered bulls only legal was; 56% NO, 44% YES and 38% NO and 62% YES, respectively. When asked if they thought the total elk population in the hunting district they hunted most during the past five years had increased, remained stable, or decreased; 22% said increased, 53% said it remained stable and 25% said it had decreased.

When asked if they thought the total number of bulls during the past five years had either increased, remained stable or decreased; 24% said increased, 38% said remained stable, and 38% said decreased.

When asked if they thought the total number of branch-antlered bulls in the population during the past five years had either increased, remained stable or decreased; 21% said increased, 35% said remained stable, and 44% said decreased.

RECOMMENDATIONS

Data collected to date from 236 marked elk captured on or near the Madison-Wall Creek and Blacktail Game Ranges have shown that these elk are much more widely distributed than previously documented. Elk should continue to be marked on these two game ranges and, if possible, elk should be marked on other important winter ranges within the study area until about 10% (500 elk) of the overall elk population is marked. These data will help with identification of herd home ranges within the overall study area and establish natality and mortality rates by sex and age class. Neonates associated with these wintering herds should also continue to be captured and instrumented with mortality sensing radio collars.

Analysis of blood samples from all elk captured will be continued. All of these blood samples should continue to be analyzed for disease and general blood chemistry while those from elk captured during winter should continue to be analyzed for protein B and pregnancy.

Intensive winter and summer classifications should be continued to help measure net recruitment of calves and various age classes of antlered bulls. Hunting mortality data should continue to be collected via check stations and jaw collections. These data will help us better understand elk population dynamics of the area before any more hunting regulation changes are made.

The first hunting regulation change should be the re-establishment of archery hunting in Hunting District 324. This is proposed to occur during the early archery season in 1988. After this is done, elk population data should continue to be collected in a similar manner previous to this re-establishment for two years before any further hunting regulation changes are made.

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